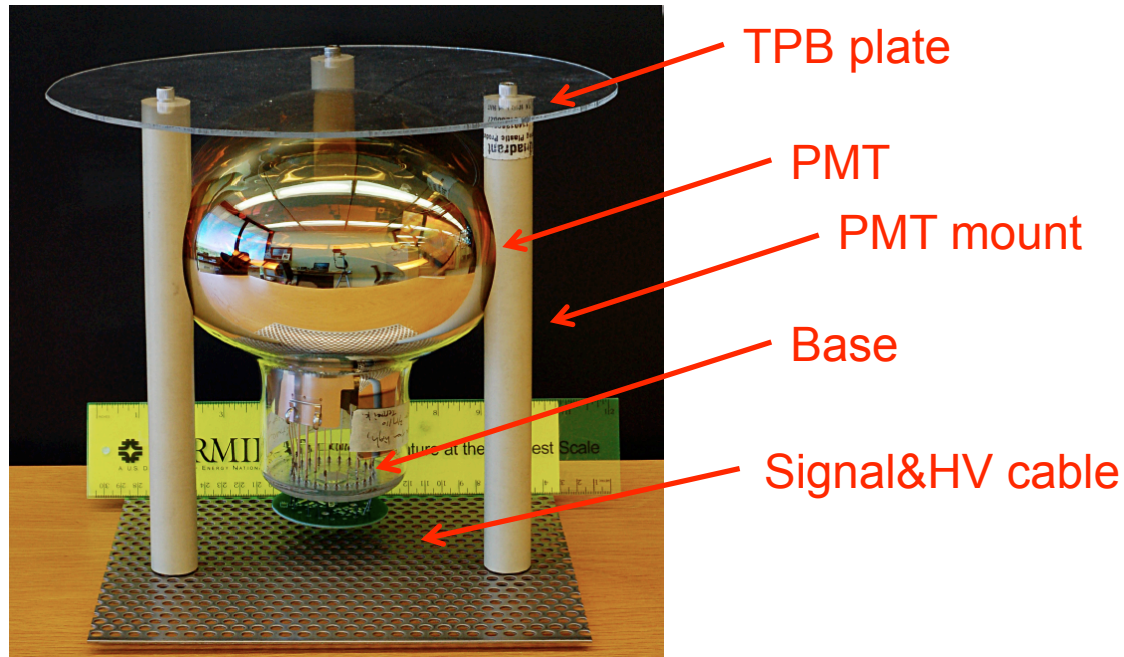


PMT, base, cable, mount, and test stand

PMT unit



1. PMT
2. base design change
3. cable and connector
4. new material test
5. magnetic shield
6. PMT global test

Teppei Katori
Massachusetts Institute of Technology
MicroBooNE PMT system technical review, Jan. 21, 2011

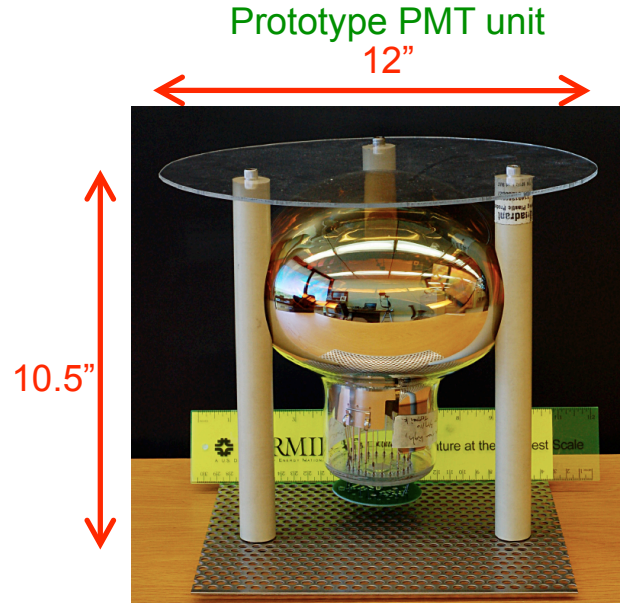
PMT

PMT

base design change
cable and connector
new material test
magnetic shield
PMT global test

Hamamatsu R5912-02mod

- 8" cryogenic high gain PMT
- positive HV operation, custom designed cryogenic base, tested, and installed
- RG180, Teflon jacket cable for signal and HV, with standard SHV connector
- signal and HV are split by the splitter located outside of the cryostat
- 3 PEEK rods on the back plate to support PMT, with TPB plate on the top
- PMT unit will fit to PMT rack



PMT base design change

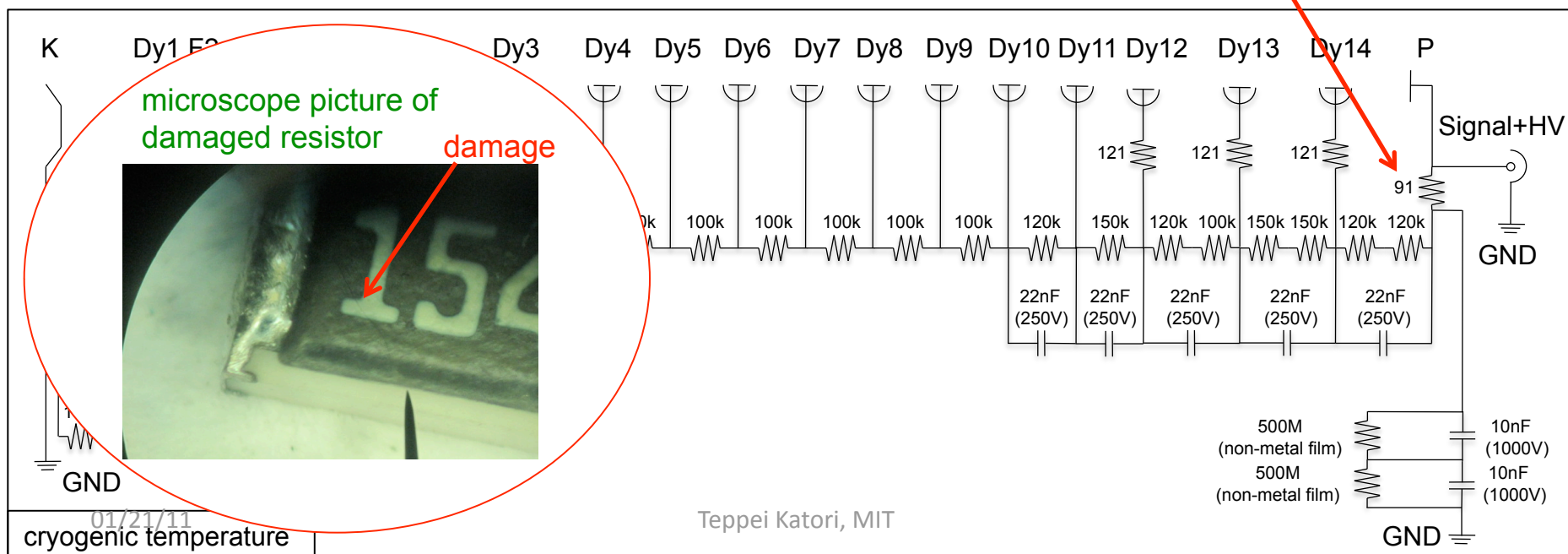
PMT
base design change
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PMT global test

Electric failure and modifications

Several bases experienced electronic damages, and it turns out the flaky connection and back termination are likely sources of this. Therefore, we decided following 3 changes,

- back termination (91 Ohm) is changed to 10k Ohm resistor.

Base schematics



PMT base design change

PMT
base design change
cable and connector
new material test
magnetic shield
PMT global test

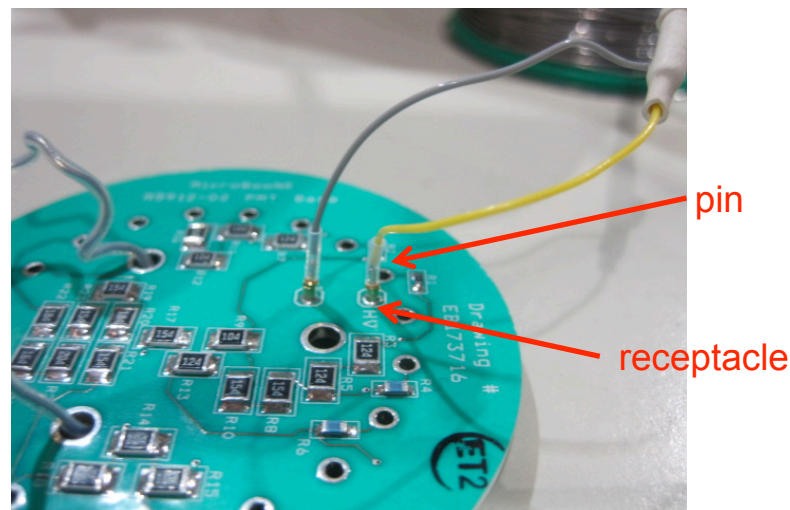
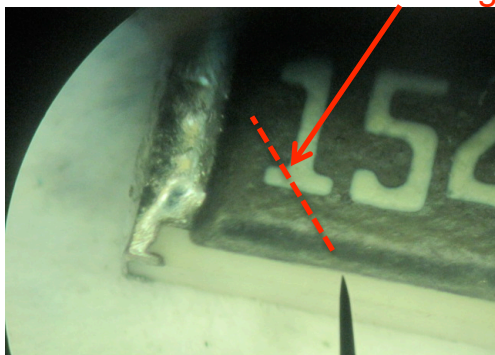
Electric failure and modifications

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- i. back termination (91 Ohm) is changed to 10k Ohm resistor
- ii. All cables and connectors will be made by technicians.
- iii. cable and base are coupled by pin-receptacle.

After these changes, we tested all bases again in LN2, and we no longer see any failures.

microscope picture of
damaged resistor



PMT base design change

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Electric failure and modifications

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All bases are soldered, and all 30 PMTs are ready to test!



Cable and connector

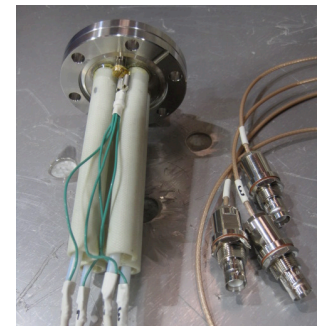
PMT
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3 sections: primary, intermediate, and external cables

PMT “primary” cables (SHV female connector) will meet “intermediate” cables coming from feed-through with SHV male connectors at patch panel in the LAr. The basic idea of this will be demonstrated by the PMT global test stand, which has prototype feed-through and pig tails with SHV male connectors.

We will test with LN2 first, then we will test with LAr.

Finally, “external” cables, both terminated with SHV female connectors, bring signal and HV from feed-through to splitter box outside of cryostat.



PMT cable SHV
female connector

feed-through pig tail
SHV male connector

New material test

PMT
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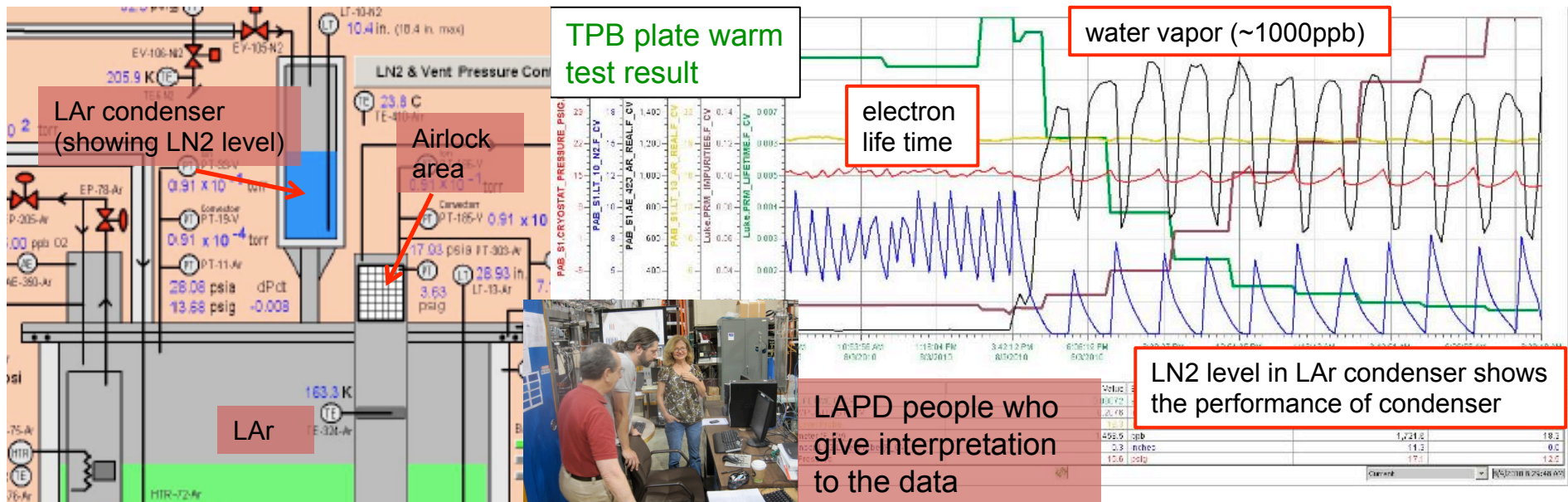
Cable and connector

Cable and connectors are successfully tested by LUKE, and electron life recovered quickly, both by warm (GAr) and cold (LAr) test. so there is no trapped air slowly released.

TPB-coated acrylic plate

Although it shows large amount of water by warm test, it gave no water nor oxygen by cold test, so we think this is not a source of impurity.

We tested all materials except PEEK rods and stainless back plate of PMT mount!



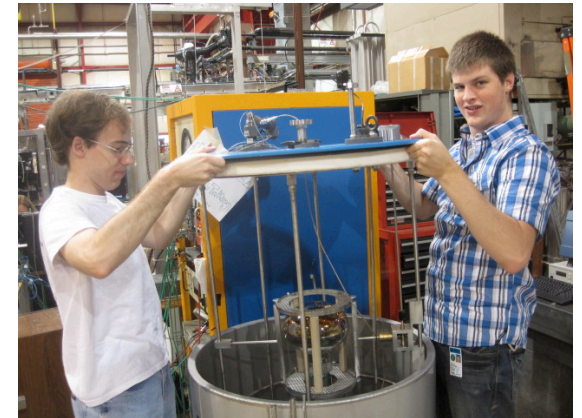
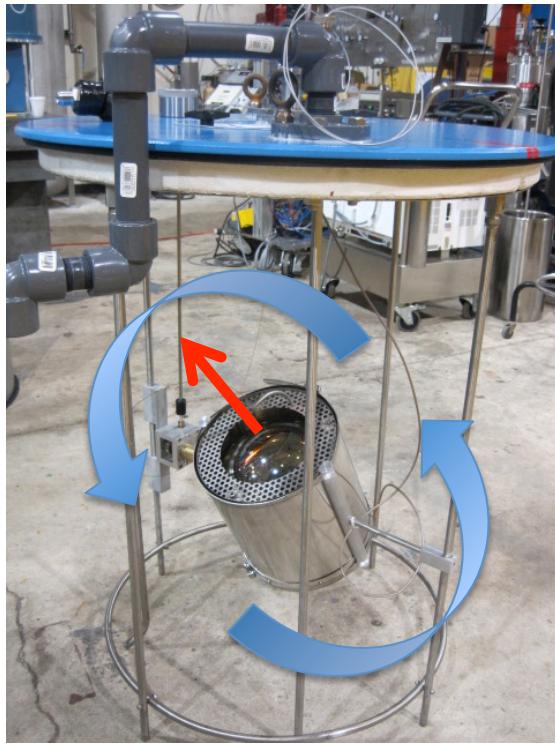
Magnetic shield study

PMT
base design change
cable and connector
new material test
magnetic shield
PMT global test

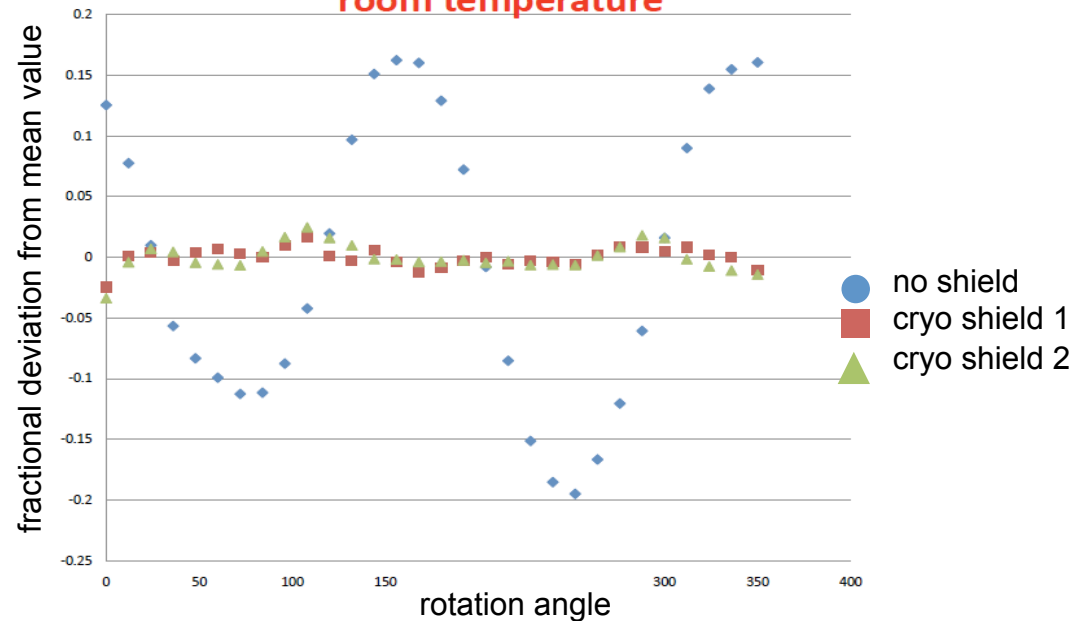
Cryogenic shield test with air

- So far, 2 cryogenic magnetic shields are tested in air, both work fine to shut out earth B-field.
- We want to test them in LN2 ~March make decision before end of May.

PMT B-field test stand



fractional deviation from mean / angle
room temperature



PMT test stand status

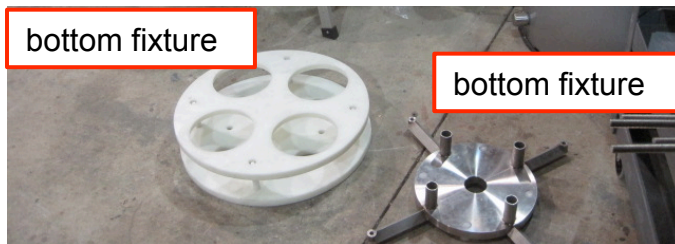
PMT test stand

There are 4 penetrations on the lid

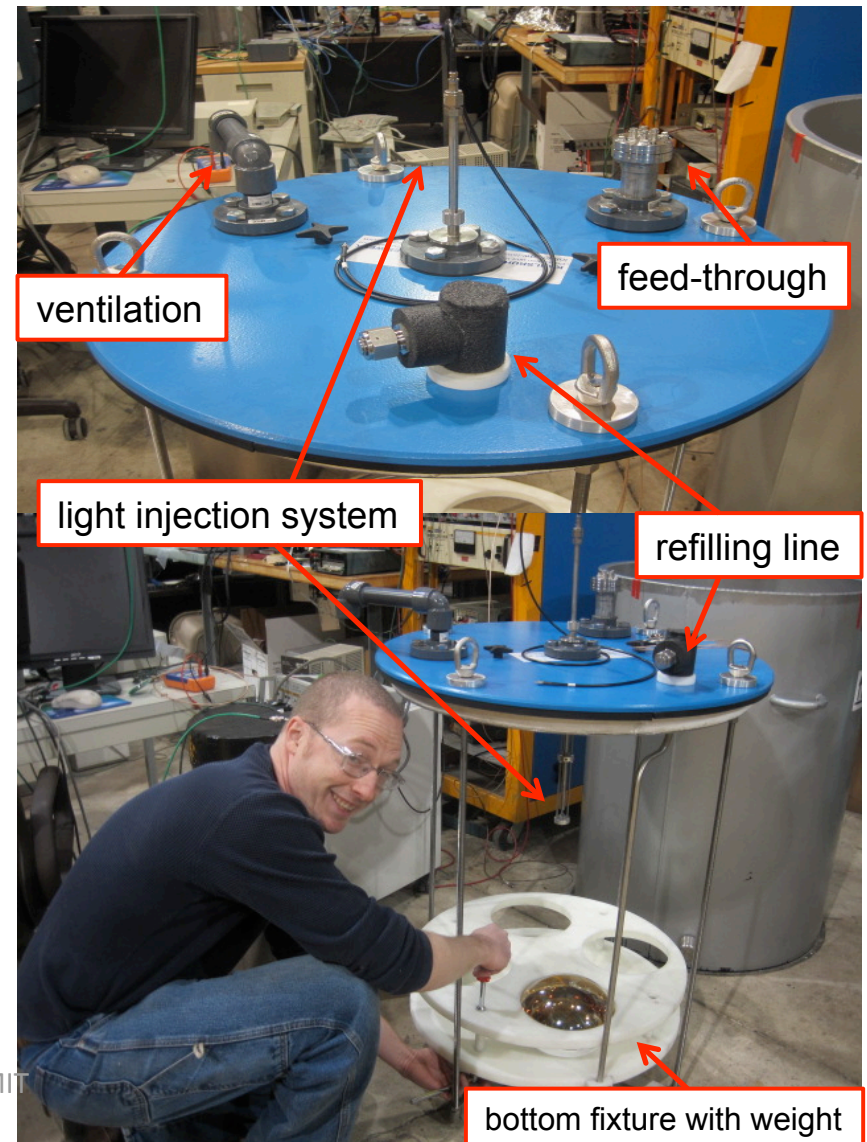
- i. LN2 refilling line
- ii. ventilation of nitrogen gas
- iii. light injection system
- iv. feed-through

4 PMTs are simultaneously immersed in the LN2 to save cooling time. They are held at the bottom of the dewar by the fixture with weight. Test will be done one PMT each.

One PMT will serve as a “benchmark” PMT, so we test 3 PMTs for each immerse.



PMT
base design change
cable and connector
new material test
magnetic shield
PMT global test

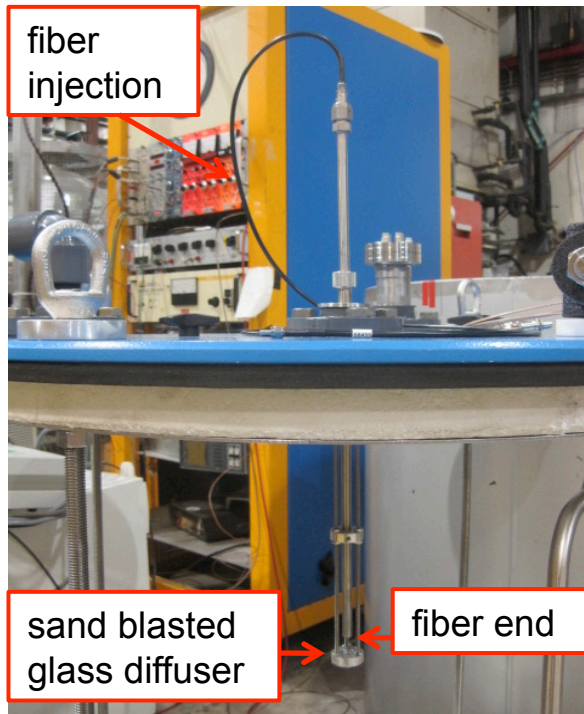


PMT test stand status

PMT test stand

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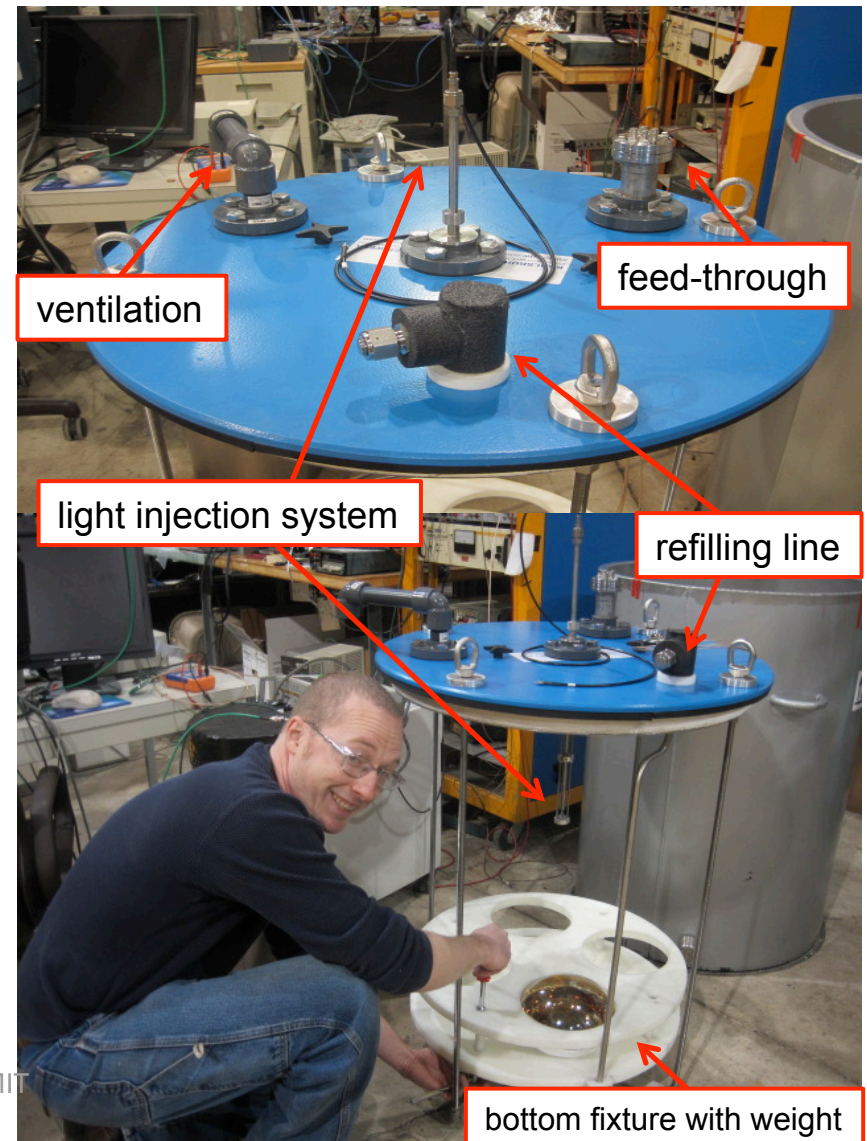
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Intensity adjustable
LED inject light to
optical fiber.

Then optical fiber
penetrates lid, and
sand-blast glass
diffuser diffuses light.

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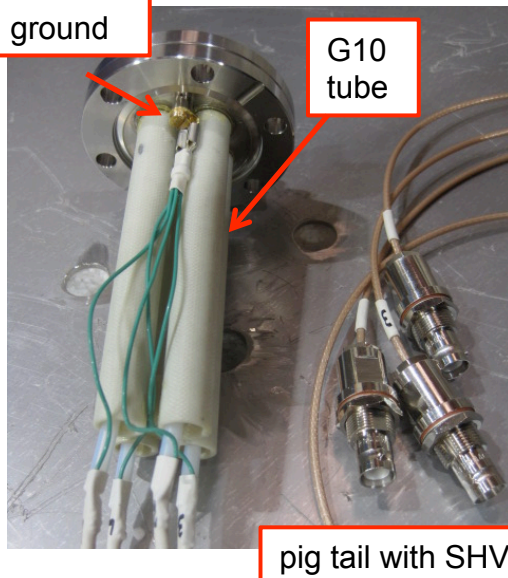


PMT test stand status

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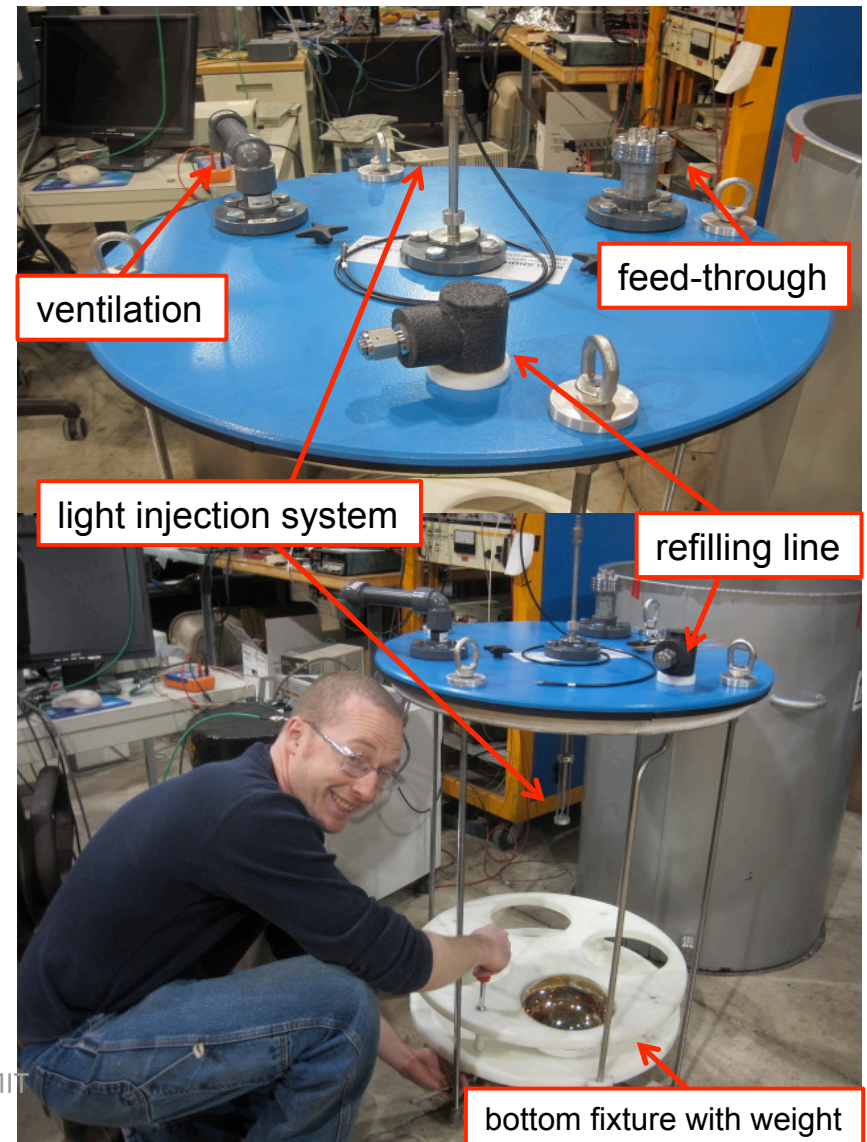


G10 tubes for HV protection, tested up to 8kV with gas Argon.

4 pig tails with SHV connectors meet PMT cables in the liquid.

This feed-through is also a demonstration of MicroBooNE prototype feed-through in real cryogenic environment.

PMT
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PMT test stand status

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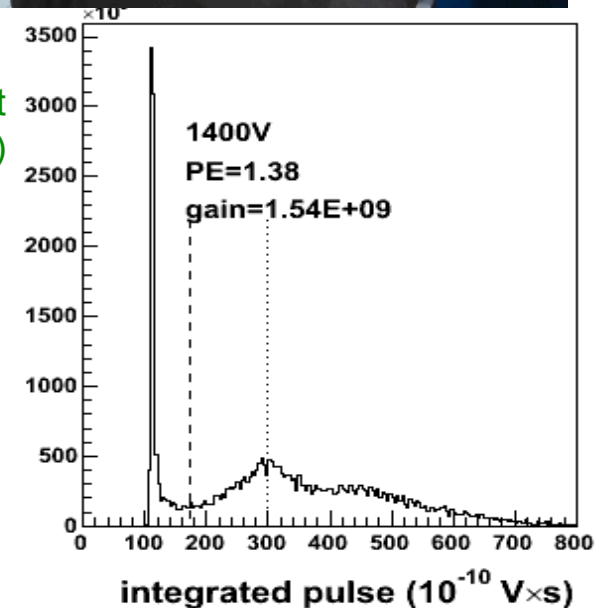
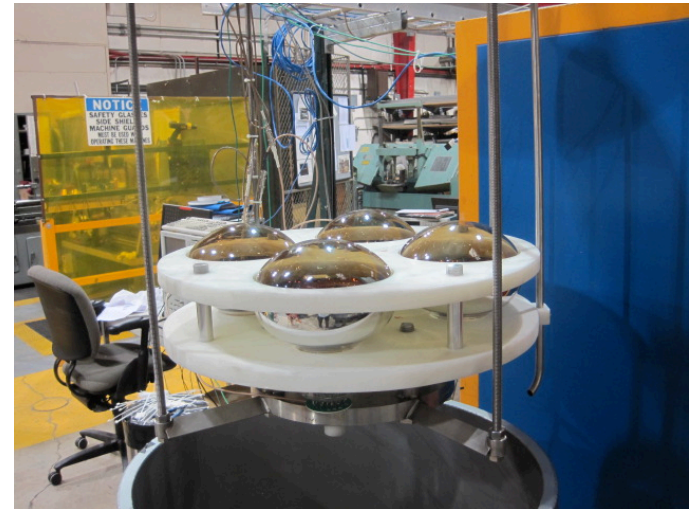
- i. LN2 refilling line
- ii. ventilation of nitrogen gas
- iii. light injection system
- iv. feed-through

Testing in air was started. We will establish testing procedure and complete air test in next 1-2 months. No help from technicians at PAB are needed (no conflict with LAPD).

Gains are measured with different HV and light intensity.

PMT01: ZD205
gain measurement
spec: 1E9 (1400V)

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PMT test stand status

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Gains are measured with different HV and light intensity.

After March, we will continue PMT test with LN2.

Thank you!

PMT
base design change
cable and connector
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